FIG.1A

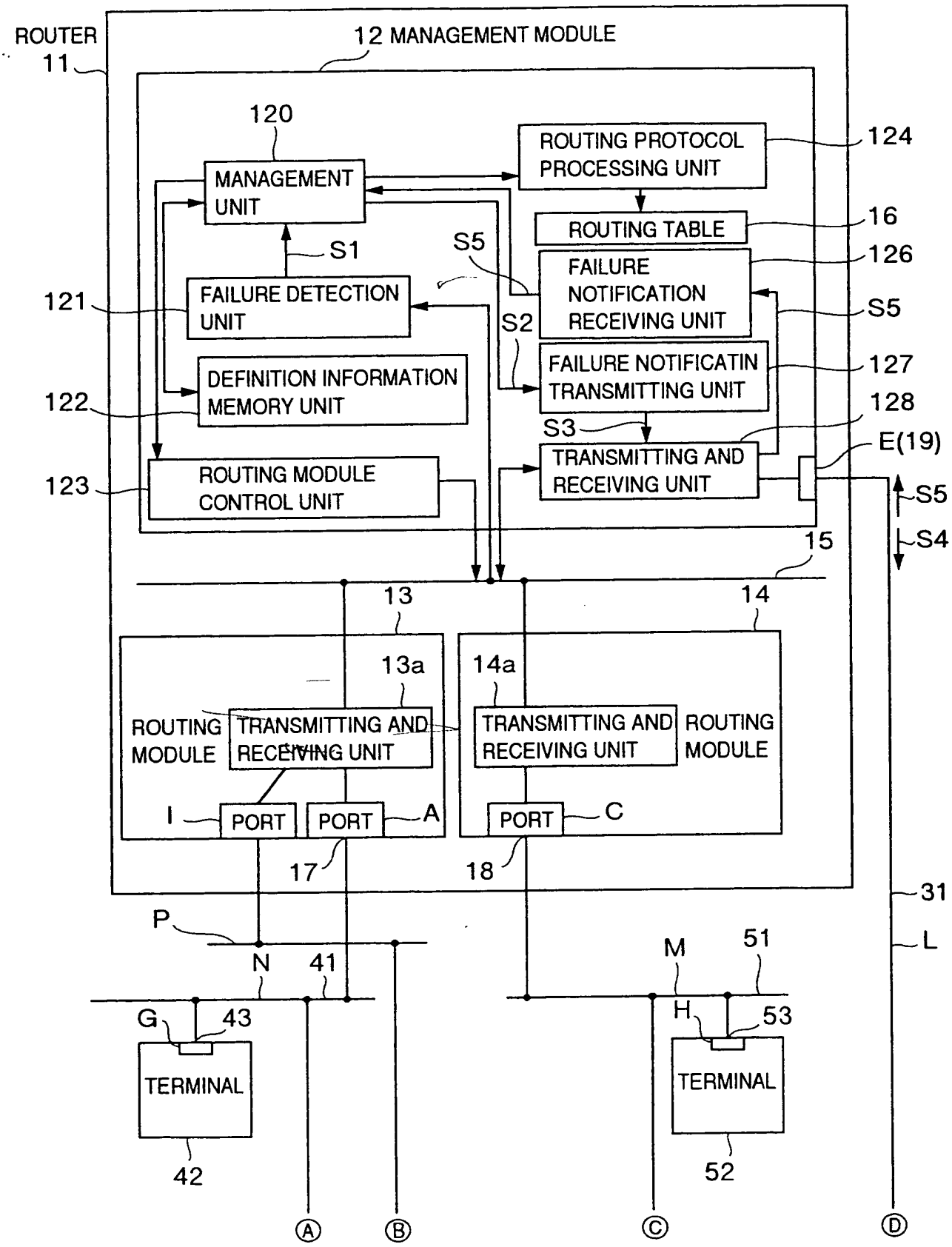

ROUTER
11
12 MANAGEMENT MODULE
120
MANAGEMENT UNIT
ROUTING PROTOCOL PROCESSING UNIT
124
ROUTING TABLE
16
S1
S5
FAILURE NOTIFICATION RECEIVING UNIT
126
121
FAILURE DETECTION UNIT
S5
S2
FAILURE NOTIFICATIN TRANSMITTING UNIT
127
122
DEFINITION INFORMATION MEMORY UNIT
128
S3
TRANSMITTING AND RECEIVING UNIT
E(19)
123
ROUTING MODULE CONTROL UNIT
S5
S4
15
13
14
13a
14a
ROUTING MODULE
TRANSMITTING AND RECEIVING UNIT
TRANSMITTING AND RECEIVING UNIT
ROUTING MODULE
I
PORT
PORT
A
PORT
C
17
18
31
P
L
N
41
M
51
G
43
H
53
TERMINAL
TERMINAL
42
52
Ⓐ
Ⓑ
Ⓒ
Ⓓ

FIG.1B

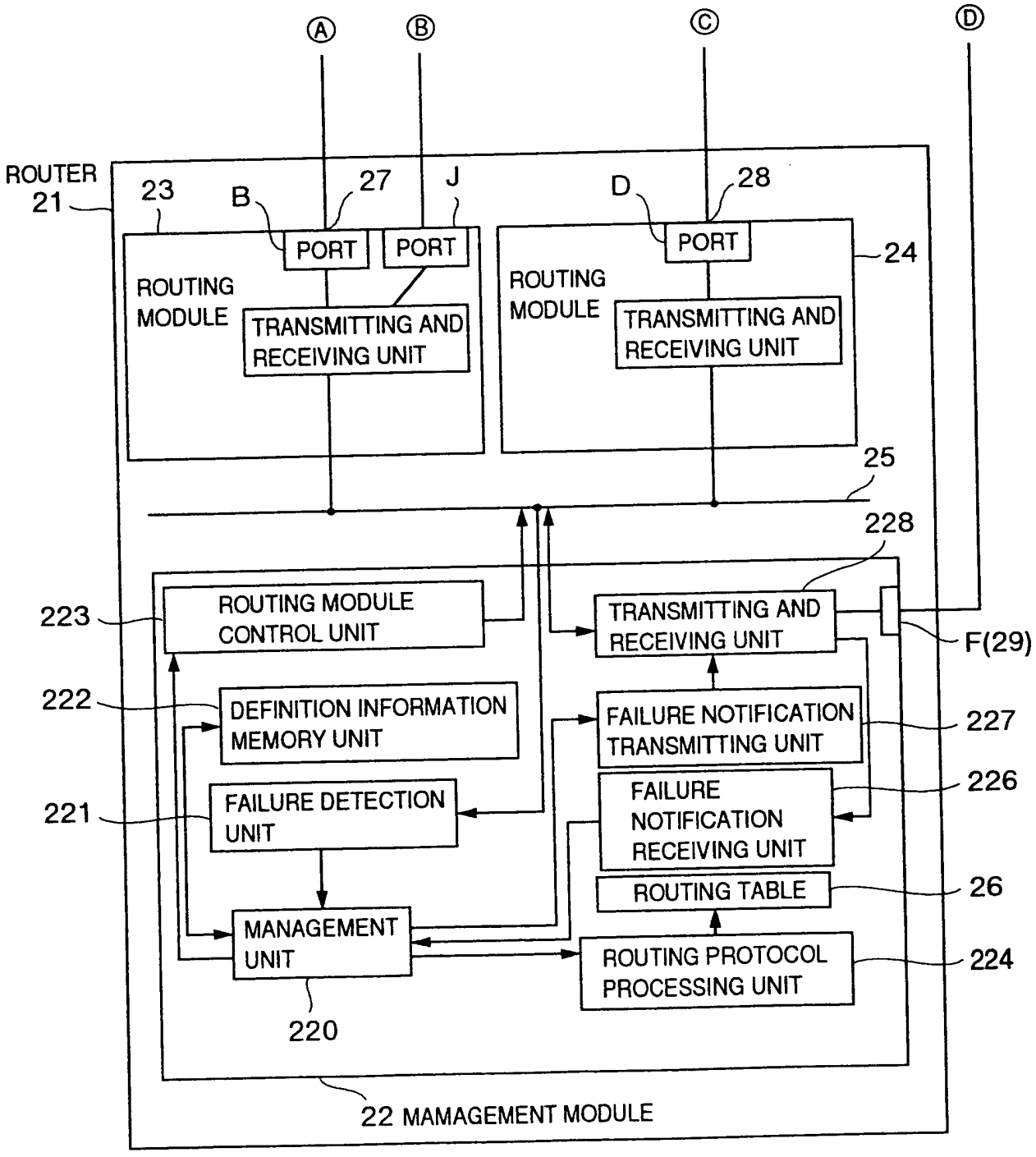

Ⓐ
Ⓑ
Ⓒ
Ⓓ
ROUTER
21
23
B
27
J
D
28
PORT
PORT
PORT
ROUTING
MODULE
TRANSMITTING AND
RECEIVING UNIT
ROUTING
MODULE
TRANSMITTING AND
RECEIVING UNIT
24
25
228
223
ROUTING MODULE
CONTROL UNIT
TRANSMITTING AND
RECEIVING UNIT
F(29)
222
DEFINITION INFORMATION
MEMORY UNIT
FAILURE NOTIFICATION
TRANSMITTING UNIT
227
221
FAILURE DETECTION
UNIT
FAILURE
NOTIFICATION
RECEIVING UNIT
226
ROUTING TABLE
26
MANAGEMENT
UNIT
ROUTING PROTOCOL
PROCESSING UNIT
224
220
22 MAMAGEMENT MODULE

FIG.2A

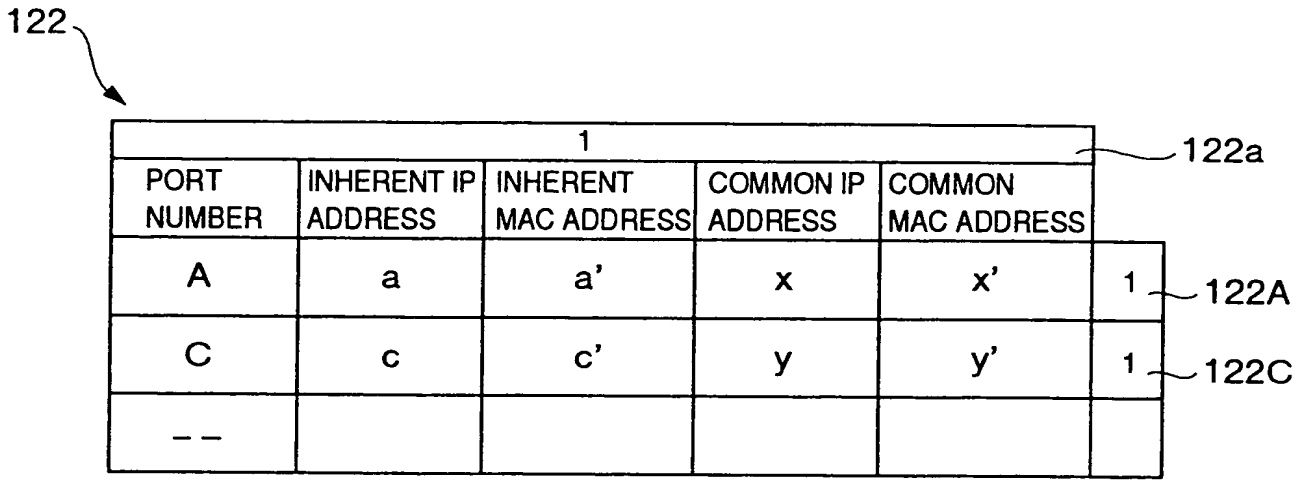

122
1
122a
PORT NUMBER
INHERENT IP ADDRESS
INHERENT MAC ADDRESS
COMMON IP ADDRESS
COMMON MAC ADDRESS
A
a
a'
x
x'
1
122A
C
c
c'
y
y'
1
122C
--

FIG.2B

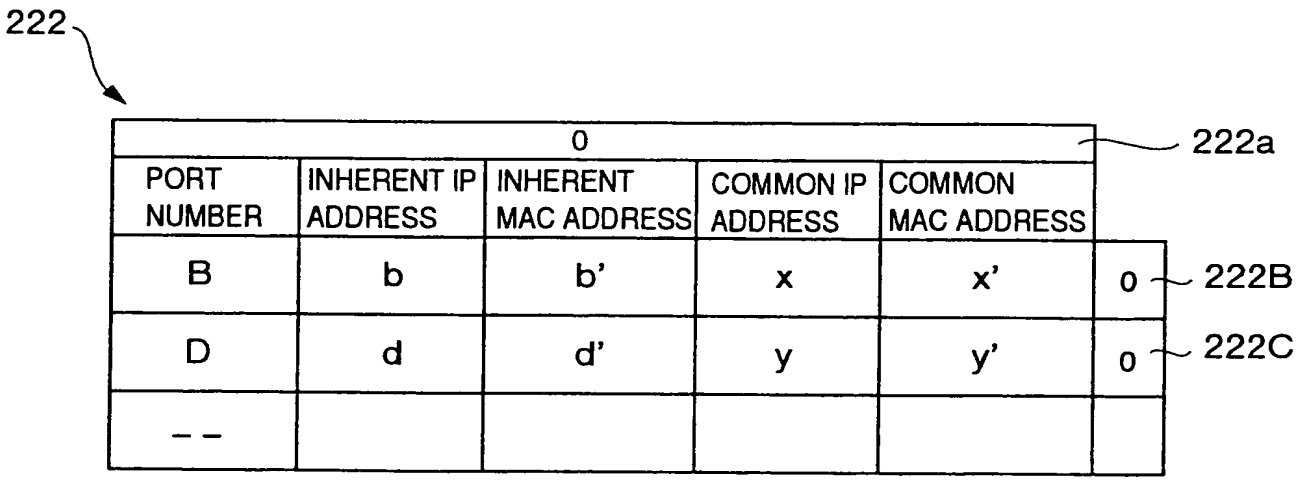

222
0
222a
PORT NUMBER
INHERENT IP ADDRESS
INHERENT MAC ADDRESS
COMMON IP ADDRESS
COMMON MAC ADDRESS
B
b
b'
x
x'
0
222B
D
d
d'
y
y'
0
222C
--

FIG.3

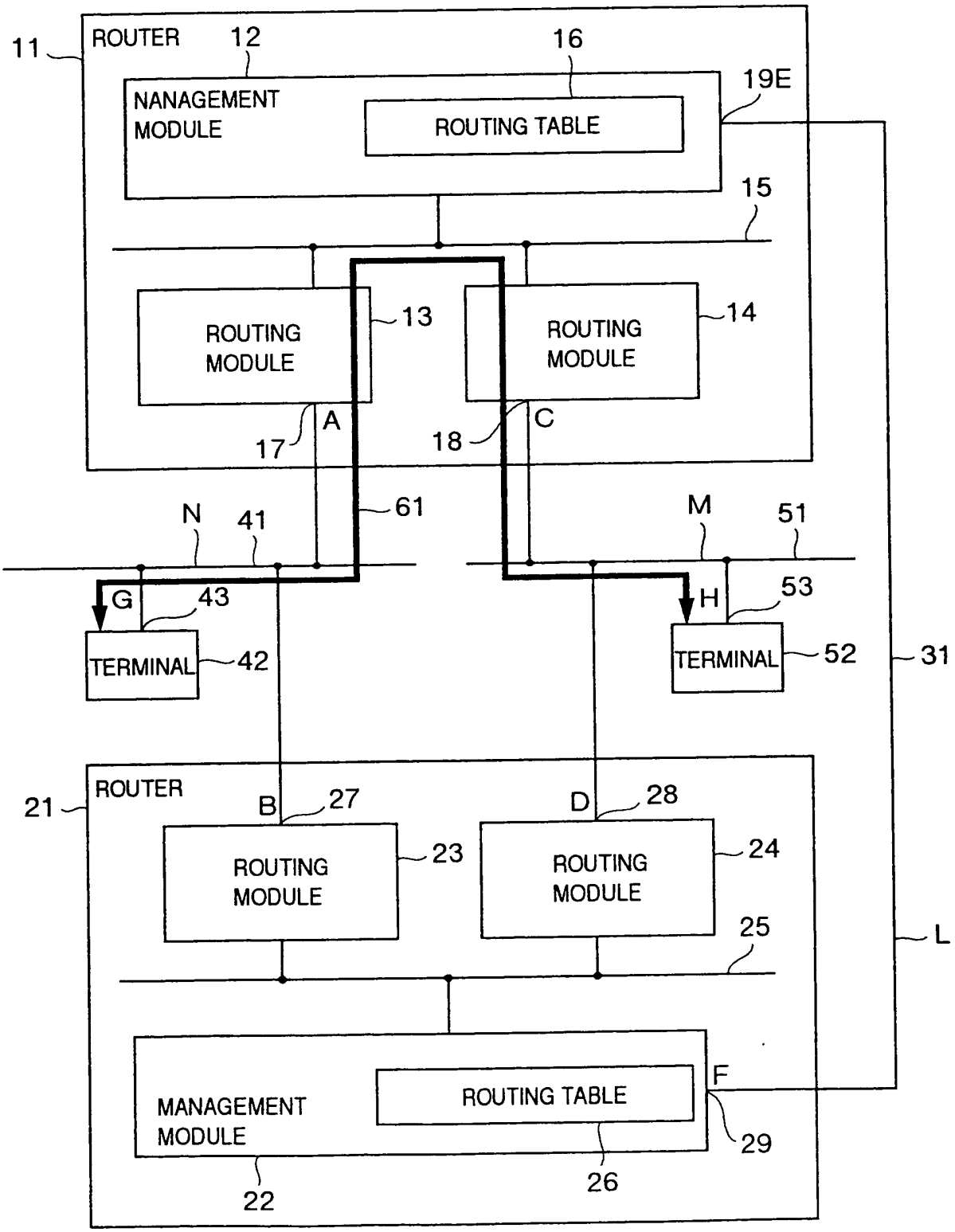

11
ROUTER
12
16
19E
NANAGEMENT MODULE
ROUTING TABLE
15
ROUTING MODULE
13
ROUTING MODULE
14
17
A
18
C
N
41
61
M
51
G
43
H
53
TERMINAL
42
TERMINAL
52
31
21
ROUTER
B
27
D
28
ROUTING MODULE
23
ROUTING MODULE
24
25
L
MANAGEMENT MODULE
ROUTING TABLE
F
29
22
26

FIG.4A

16

DESTINATION	NEXT HOP
NETWORK N	x
NETWORK M	y
NETWORK L	e

FIG.4B

26

DESTINATION	NEXT HOP
NETWORK N	b
NETWORK M	d
NETWORK L	f

FIG.5

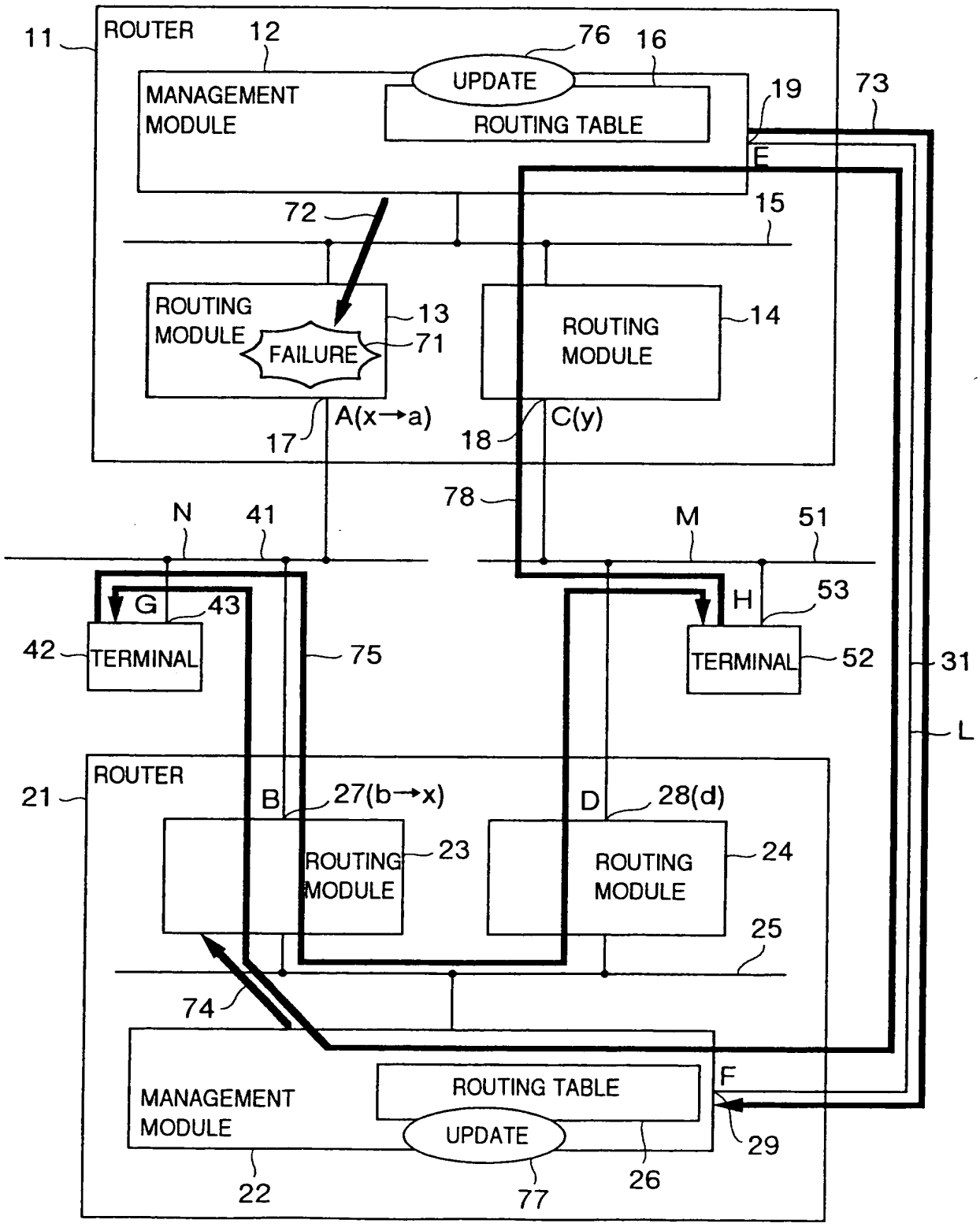

11
ROUTER
12
76
16
UPDATE
MANAGEMENT MODULE
ROUTING TABLE
19
73
E
15
72
ROUTING MODULE
13
FAILURE
71
ROUTING MODULE
14
17
A(x→a)
18
C(y)
78
N
41
M
51
G
43
H
53
42
TERMINAL
75
TERMINAL
52
31
L
21
ROUTER
B
27(b→x)
D
28(d)
ROUTING MODULE
23
ROUTING MODULE
24
25
74
MANAGEMENT MODULE
ROUTING TABLE
F
UPDATE
29
22
77
26

FIG.6A

16

DESTINATION	NEXT HOP
NETWORK N	e
NETWORK M	y
NETWORK L	e

FIG.6B

26

DESTINATION	NEXT HOP
NETWORK N	x
NETWORK M	d
NETWORK L	f

FIG.7

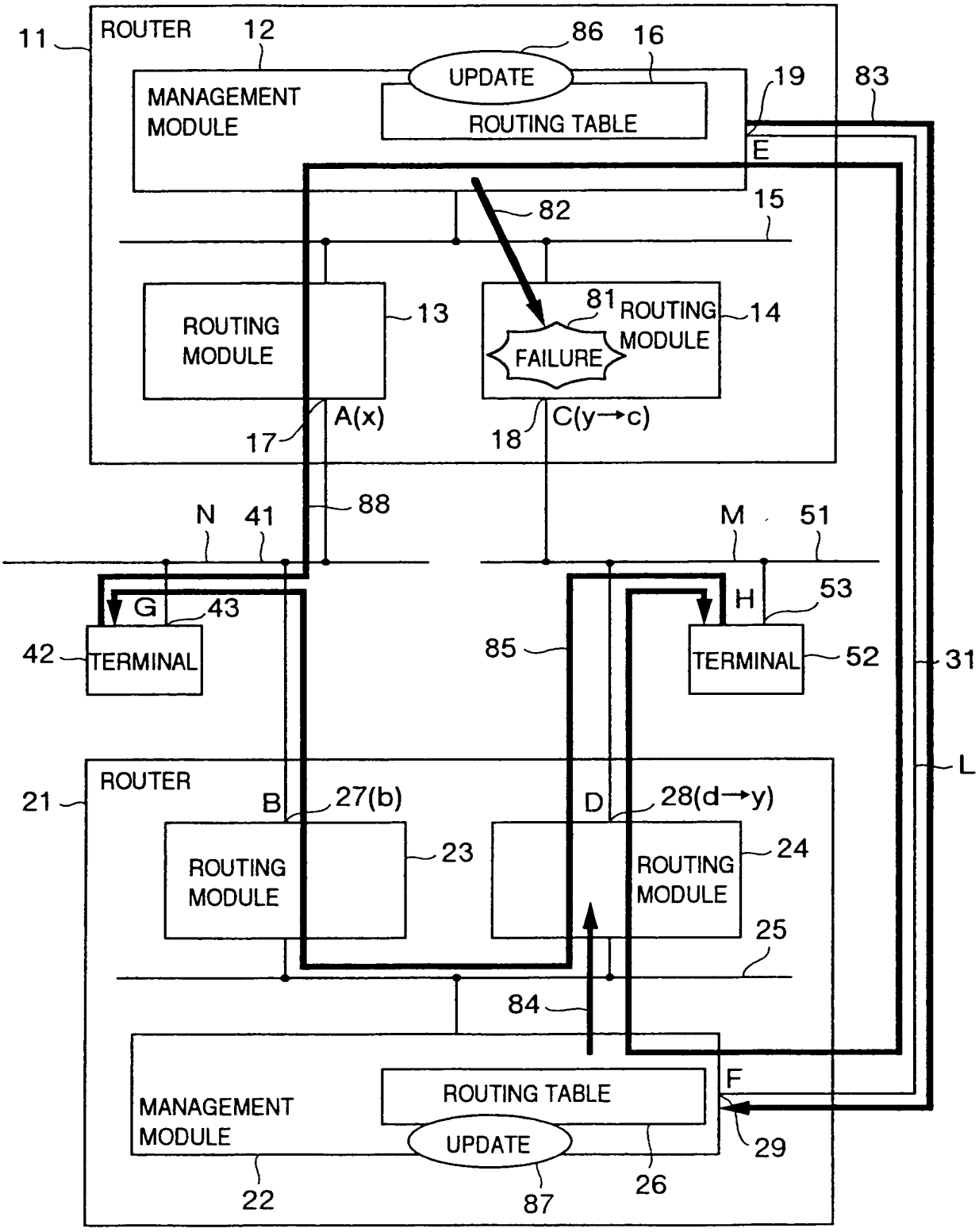

11
ROUTER
12
86
16
UPDATE
MANAGEMENT MODULE
ROUTING TABLE
19
83
E
15
82
ROUTING MODULE
13
81
ROUTING MODULE
14
FAILURE
A(x)
17
18
C(y→c)
N
41
88
M
51
G
43
H
53
42
TERMINAL
85
TERMINAL
52
31
L
21
ROUTER
B
27(b)
D
28(d→y)
ROUTING MODULE
23
ROUTING MODULE
24
25
84
MANAGEMENT MODULE
ROUTING TABLE
F
UPDATE
29
22
87
26

FIG.8A

16

DESTINATION	NEXT HOP
NETWORK N	x
NETWORK M	e
NETWORK L	e

FIG.8B

26

DESTINATION	NEXT HOP
NETWORK N	b
NETWORK M	y
NETWORK L	f

FIG.9

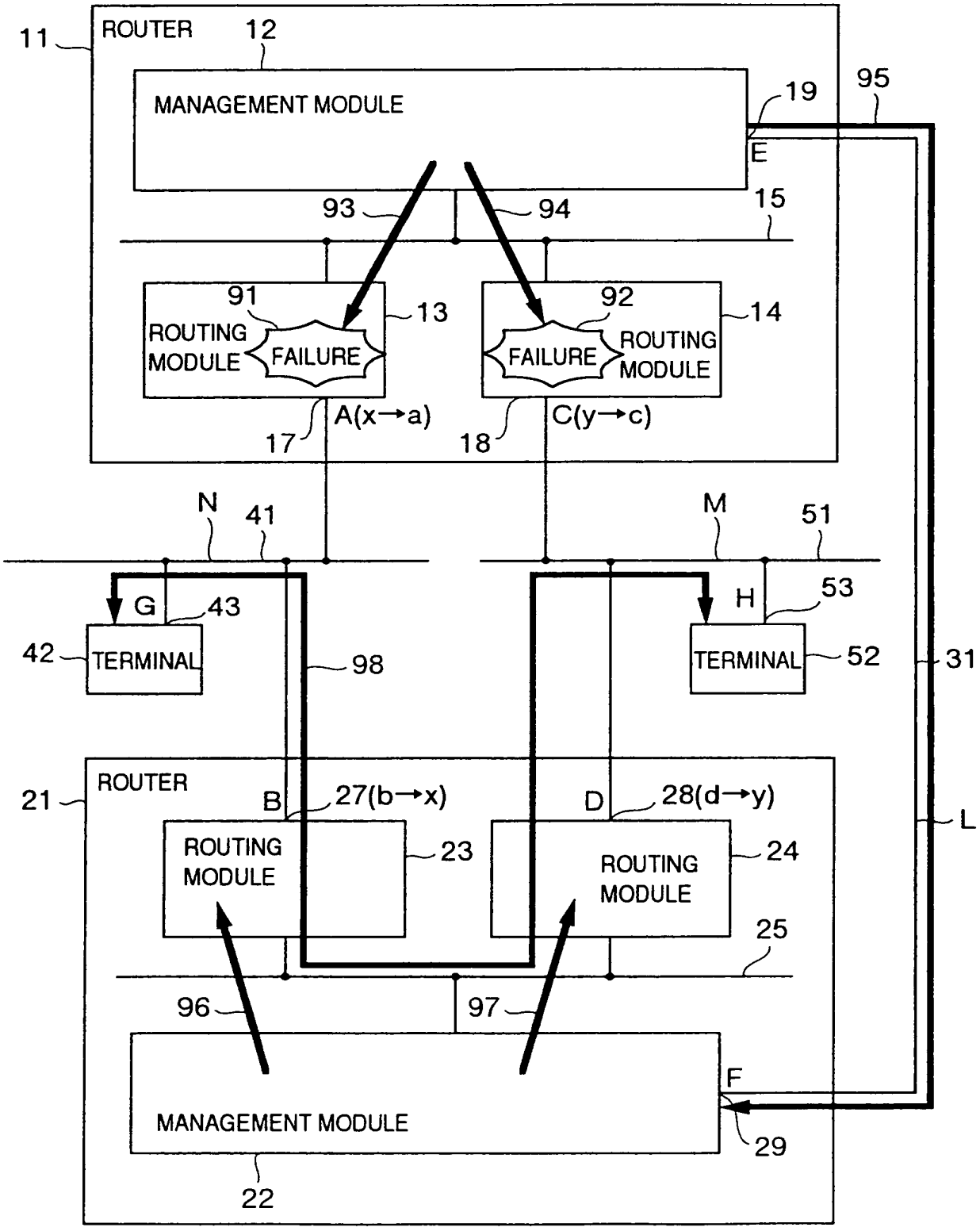

11
ROUTER
12
MANAGEMENT MODULE
19
95
E
93
94
15
91
13
ROUTING MODULE
FAILURE
92
14
FAILURE
ROUTING MODULE
17
A(x→a)
18
C(y→c)
N
41
M
51
G
43
H
53
42
TERMINAL
98
TERMINAL
52
31
21
ROUTER
B
27(b→x)
D
28(d→y)
ROUTING MODULE
23
ROUTING MODULE
24
L
25
96
97
MANAGEMENT MODULE
F
29
22

FIG.10A

16

DESTINATION	NEXT HOP
NETWORK N	e
NETWORK M	e
NETWORK L	e

FIG.10B

26

DESTINATION	NEXT HOP
NETWORK N	x
NETWORK M	y
NETWORK L	f

FIG.11

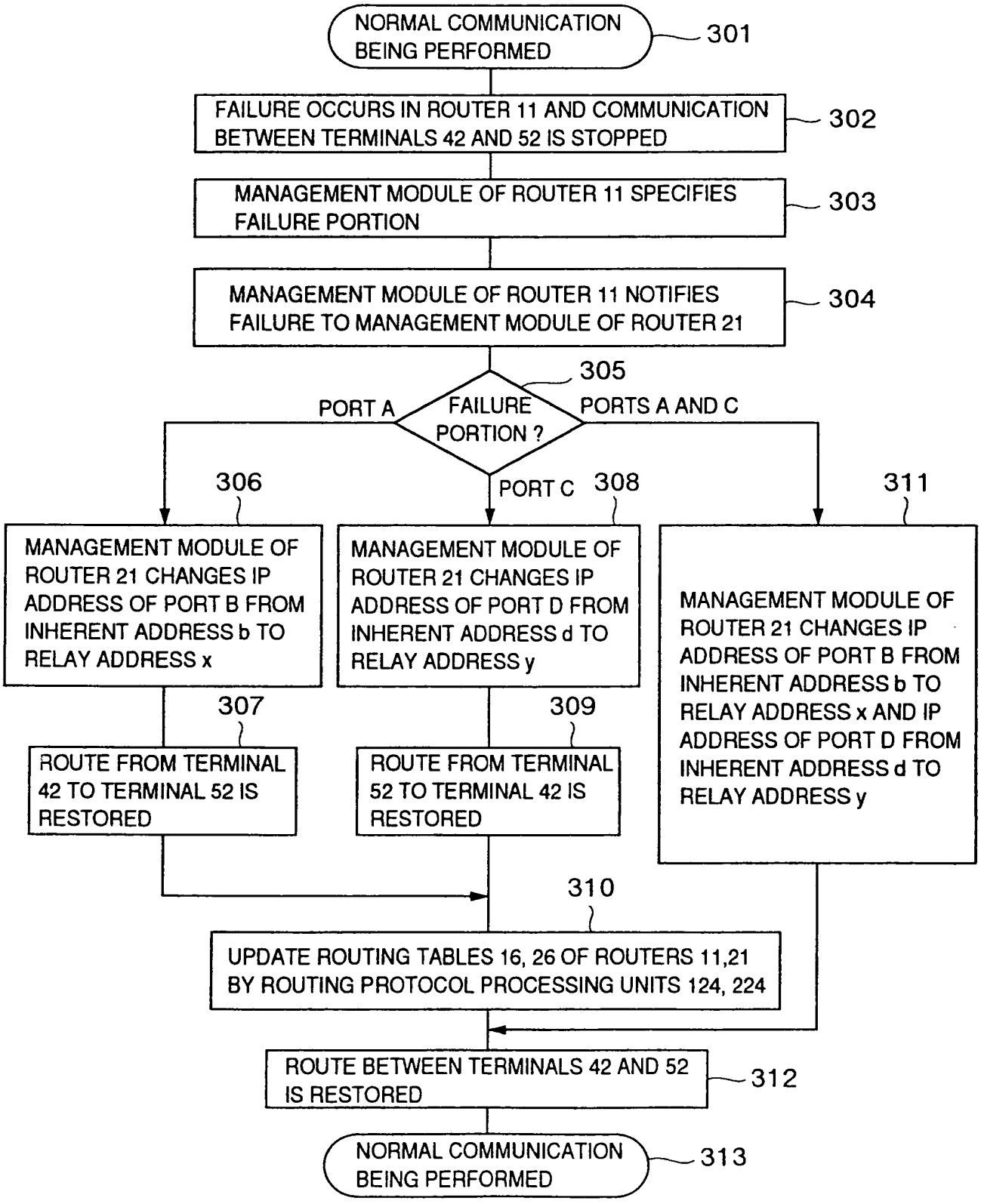

NORMAL COMMUNICATION BEING PERFORMED
301
FAILURE OCCURS IN ROUTER 11 AND COMMUNICATION BETWEEN TERMINALS 42 AND 52 IS STOPPED
302
MANAGEMENT MODULE OF ROUTER 11 SPECIFIES FAILURE PORTION
303
MANAGEMENT MODULE OF ROUTER 11 NOTIFIES FAILURE TO MANAGEMENT MODULE OF ROUTER 21
304
305
FAILURE PORTION ?
PORT A
PORT C
PORTS A AND C
306
MANAGEMENT MODULE OF ROUTER 21 CHANGES IP ADDRESS OF PORT B FROM INHERENT ADDRESS b TO RELAY ADDRESS x
307
ROUTE FROM TERMINAL 42 TO TERMINAL 52 IS RESTORED
308
MANAGEMENT MODULE OF ROUTER 21 CHANGES IP ADDRESS OF PORT D FROM INHERENT ADDRESS d TO RELAY ADDRESS y
309
ROUTE FROM TERMINAL 52 TO TERMINAL 42 IS RESTORED
311
MANAGEMENT MODULE OF ROUTER 21 CHANGES IP ADDRESS OF PORT B FROM INHERENT ADDRESS b TO RELAY ADDRESS x AND IP ADDRESS OF PORT D FROM INHERENT ADDRESS d TO RELAY ADDRESS y
310
UPDATE ROUTING TABLES 16, 26 OF ROUTERS 11,21 BY ROUTING PROTOCOL PROCESSING UNITS 124, 224
ROUTE BETWEEN TERMINALS 42 AND 52 IS RESTORED
312
NORMAL COMMUNICATION BEING PERFORMED
313

FIG.12

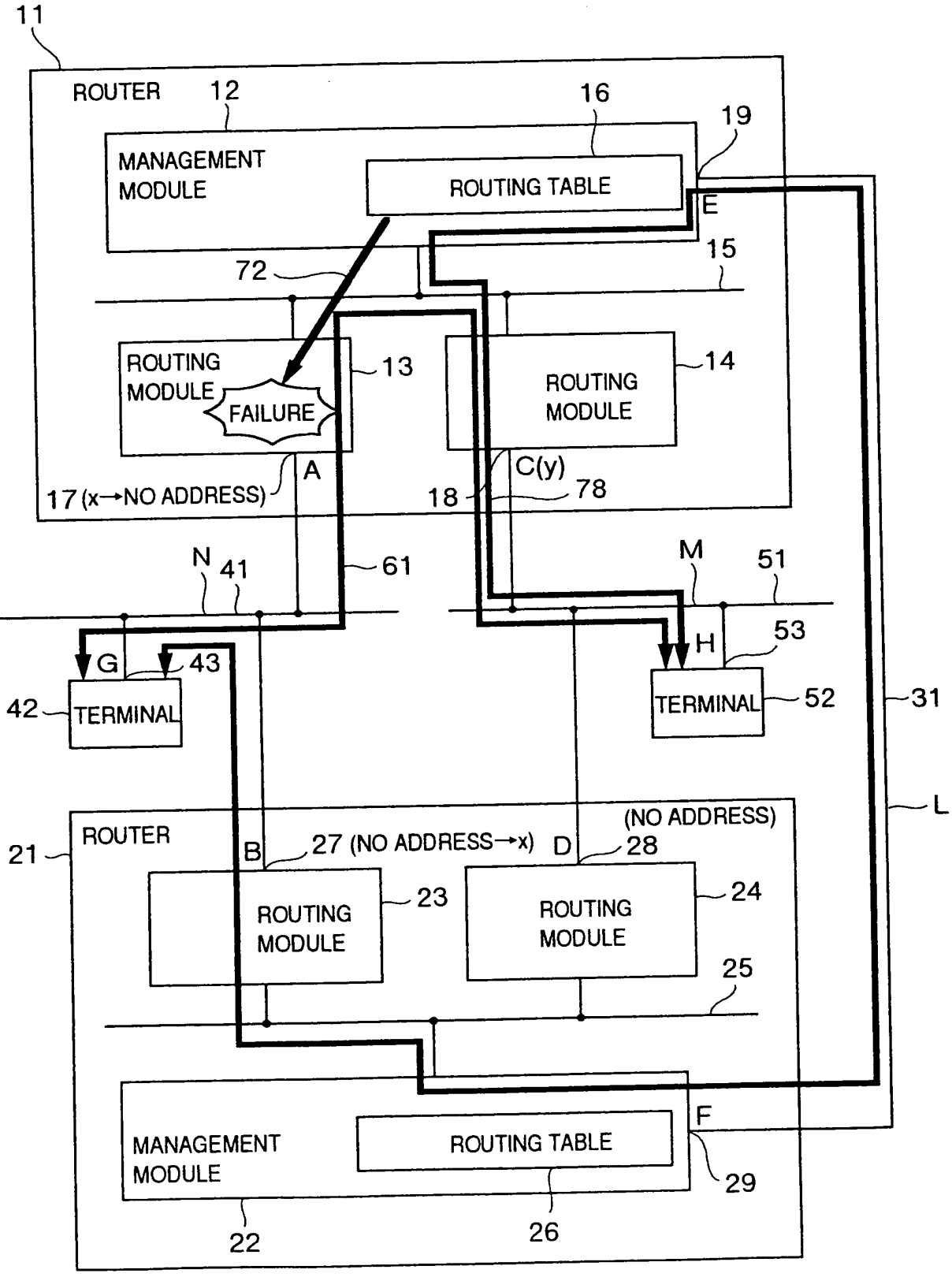

11
ROUTER
12
16
19
MANAGEMENT MODULE
ROUTING TABLE
E
15
72
ROUTING MODULE
FAILURE
13
ROUTING MODULE
14
A
C(y)
17 (x→NO ADDRESS)
18
78
N
41
61
M
51
G
43
H
53
42
TERMINAL
TERMINAL
52
31
L
(NO ADDRESS)
ROUTER
21
B
27 (NO ADDRESS→x)
D
28
ROUTING MODULE
23
ROUTING MODULE
24
25
MANAGEMENT MODULE
ROUTING TABLE
F
29
22
26

FIG.13A

16

DESTINATION	NEXT HOP
NETWORK N	e
NETWORK M	y
NETWORK L	e

FIG.13B

26

DESTINATION	NEXT HOP
NETWORK N	x
NETWORK M	f
NETWORK L	f

FIG.14

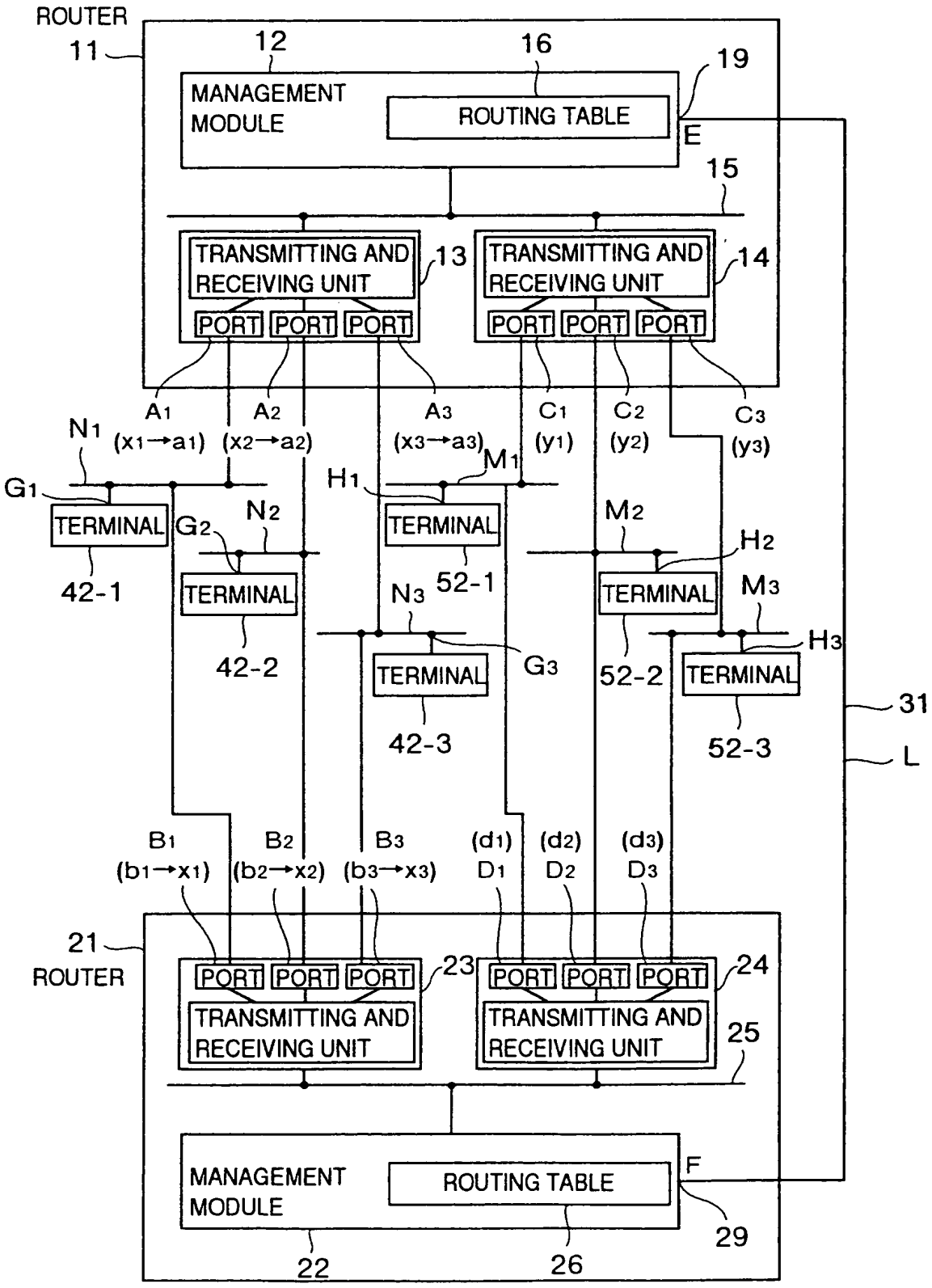

ROUTER
11
12
16
19
MANAGEMENT MODULE
ROUTING TABLE
E
15
TRANSMITTING AND RECEIVING UNIT
13
TRANSMITTING AND RECEIVING UNIT
14
PORT
PORT
PORT
PORT
PORT
PORT
A1
A2
A3
C1
C2
C3
N1
(x1→a1)
(x2→a2)
(x3→a3)
(y1)
(y2)
(y3)
M1
G1
H1
TERMINAL
N2
G2
TERMINAL
TERMINAL
M2
H2
42-1
52-1
TERMINAL
N3
M3
42-2
H3
TERMINAL
G3
TERMINAL
52-2
TERMINAL
31
42-3
52-3
L
B1
B2
B3
(d1)
(d2)
(d3)
(b1→x1)
(b2→x2)
(b3→x3)
D1
D2
D3
21
ROUTER
PORT
PORT
PORT
23
PORT
PORT
PORT
24
TRANSMITTING AND RECEIVING UNIT
TRANSMITTING AND RECEIVING UNIT
25
MANAGEMENT MODULE
ROUTING TABLE
F
29
22
26

FIG.15A

16

DESTINATION	NEXT HOP
NETWORK N1	x_1
NETWORK N2	x_2
NETWORK N3	x_3
NETWORK M1	y_1
NETWORK M2	y_2
NETWORK M3	y_3
NETWORK L	e

FIG.15B

26

DESTINATION	NEXT HOP
NETWORK N1	b_1
NETWORK N2	b_2
NETWORK N3	b_3
NETWORK M1	d_1
NETWORK M2	d_2
NETWORK M3	d_3
NETWORK L	f

FIG.16A

16

DESTINATION	NEXT HOP
NETWORK N1	e
NETWORK N2	e
NETWORK N3	e
NETWORK M1	y_1
NETWORK M2	y_2
NETWORK M3	y_3
NETWORK L	e

FIG.16B

26

DESTINATION	NEXT HOP
NETWORK N1	x_1
NETWORK N2	x_2
NETWORK N3	x_3
NETWORK M1	d_1
NETWORK M2	d_2
NETWORK M3	d_3
NETWORK L	f

FIG.17A

16

DESTINATION	NEXT HOP
NETWORK N1	e
NETWORK N2	x_2
NETWORK N3	x_3
NETWORK M1	y_1
NETWORK M2	y_2
NETWORK M3	y_3
NETWORK L	e

FIG.17B

26

DESTINATION	NEXT HOP
NETWORK N1	x_1
NETWORK N2	b_1
NETWORK N3	b_2
NETWORK M1	d_1
NETWORK M2	d_2
NETWORK M3	d_3
NETWORK L	f

FIG.18A

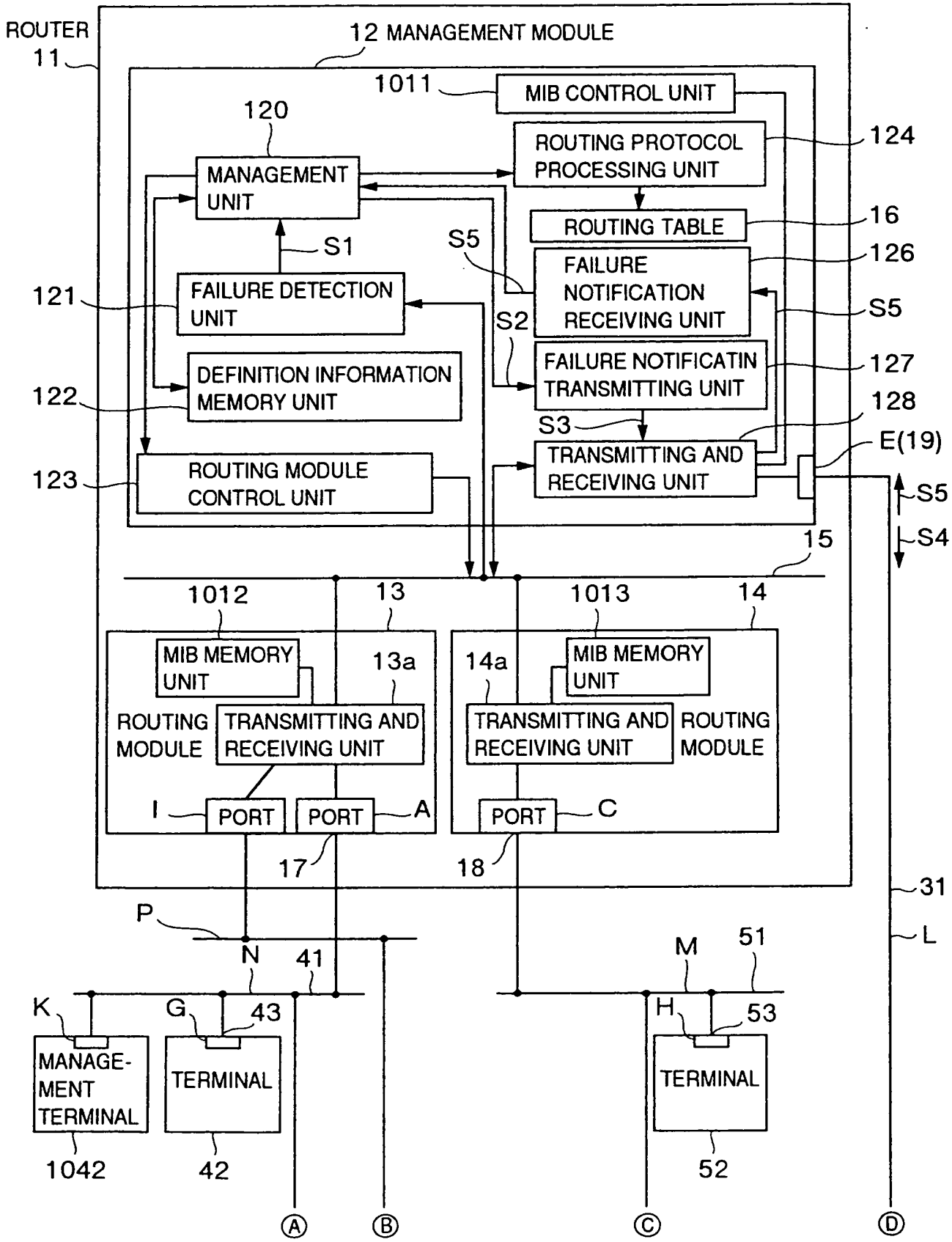

ROUTER
11
12 MANAGEMENT MODULE
1011
MIB CONTROL UNIT
120
MANAGEMENT UNIT
ROUTING PROTOCOL PROCESSING UNIT
124
ROUTING TABLE
16
S1
S5
FAILURE NOTIFICATION RECEIVING UNIT
126
121
FAILURE DETECTION UNIT
S2
S5
FAILURE NOTIFICATIN TRANSMITTING UNIT
127
122
DEFINITION INFORMATION MEMORY UNIT
128
S3
TRANSMITTING AND RECEIVING UNIT
E(19)
123
ROUTING MODULE CONTROL UNIT
S5
S4
15
1012
13
1013
14
MIB MEMORY UNIT
13a
14a
MIB MEMORY UNIT
ROUTING MODULE
TRANSMITTING AND RECEIVING UNIT
TRANSMITTING AND RECEIVING UNIT
ROUTING MODULE
I
PORT
PORT
A
PORT
C
17
18
31
P
L
N
41
M
51
K
G
43
H
53
MANAGE-MENT TERMINAL
TERMINAL
TERMINAL
1042
42
52
Ⓐ
Ⓑ
Ⓒ
Ⓓ

FIG.18B

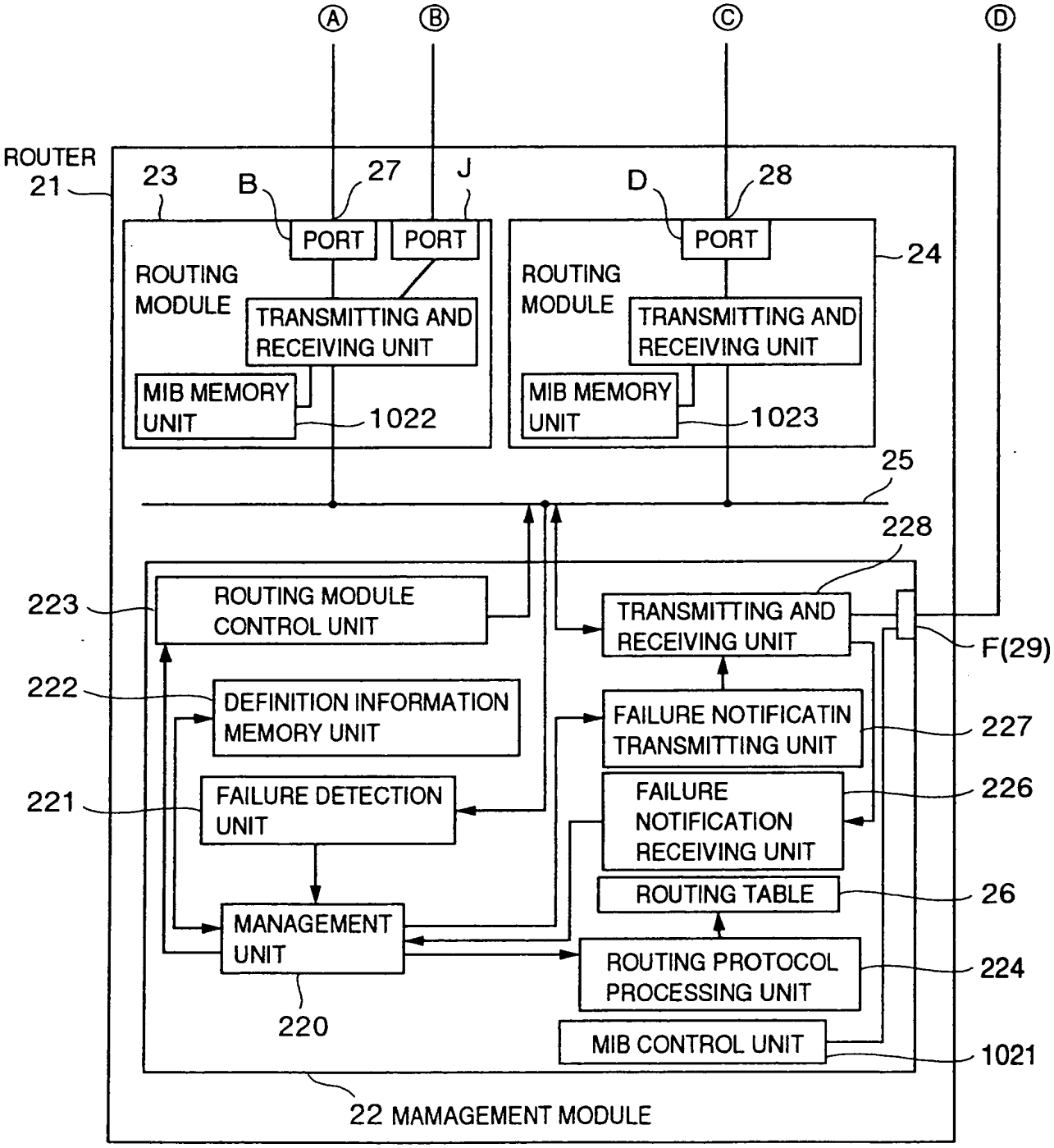

Ⓐ
Ⓑ
Ⓒ
Ⓓ
ROUTER
21
23
B
27
J
D
28
PORT
PORT
PORT
ROUTING
MODULE
TRANSMITTING AND
RECEIVING UNIT
MIB MEMORY
UNIT
1022
ROUTING
MODULE
TRANSMITTING AND
RECEIVING UNIT
MIB MEMORY
UNIT
1023
24
25
228
223
ROUTING MODULE
CONTROL UNIT
TRANSMITTING AND
RECEIVING UNIT
F(29)
222
DEFINITION INFORMATION
MEMORY UNIT
FAILURE NOTIFICATIN
TRANSMITTING UNIT
227
221
FAILURE DETECTION
UNIT
FAILURE
NOTIFICATION
RECEIVING UNIT
226
ROUTING TABLE
26
MANAGEMENT
UNIT
ROUTING PROTOCOL
PROCESSING UNIT
224
220
MIB CONTROL UNIT
1021
22 MAMAGEMENT MODULE

FIG.19

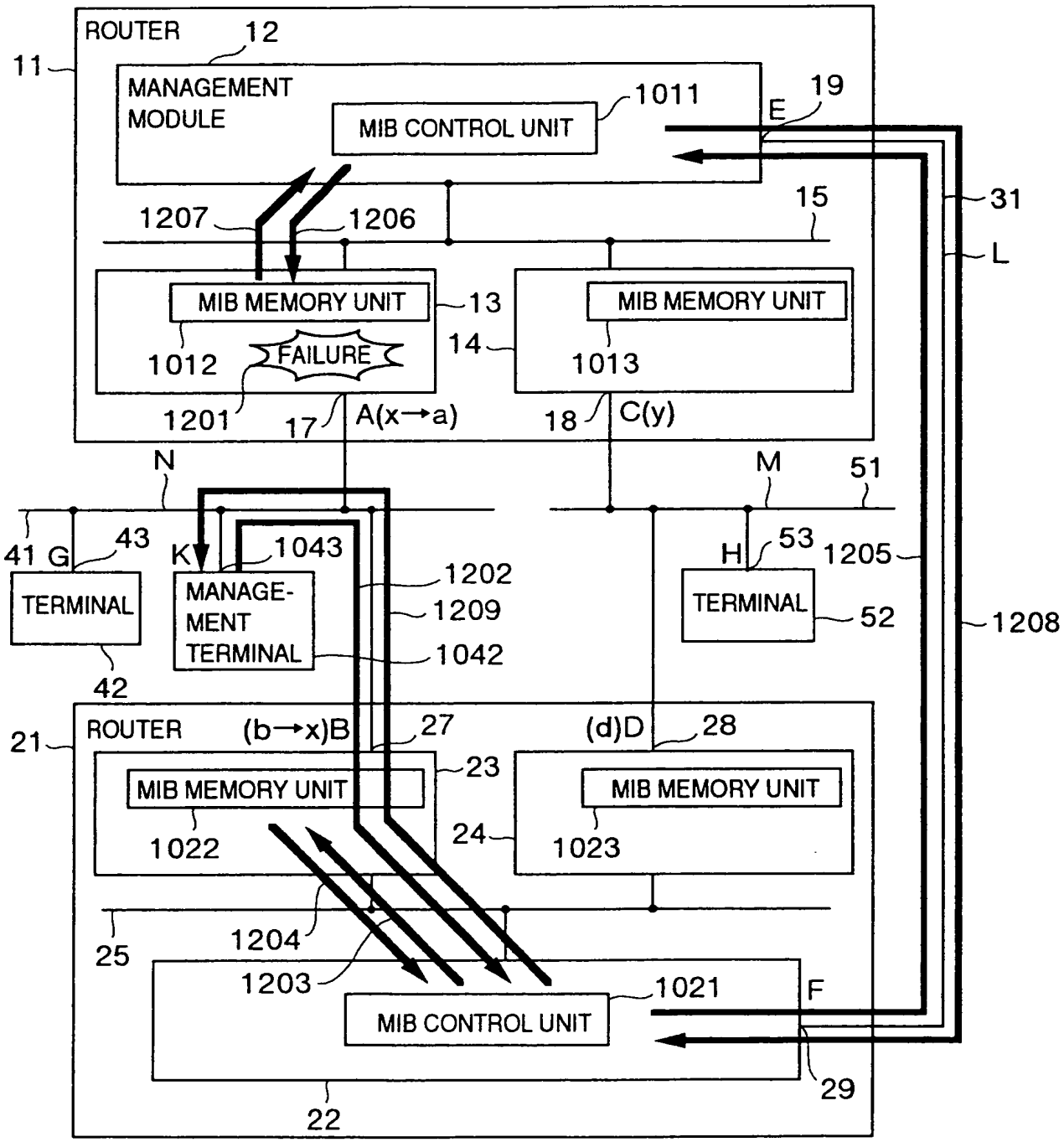
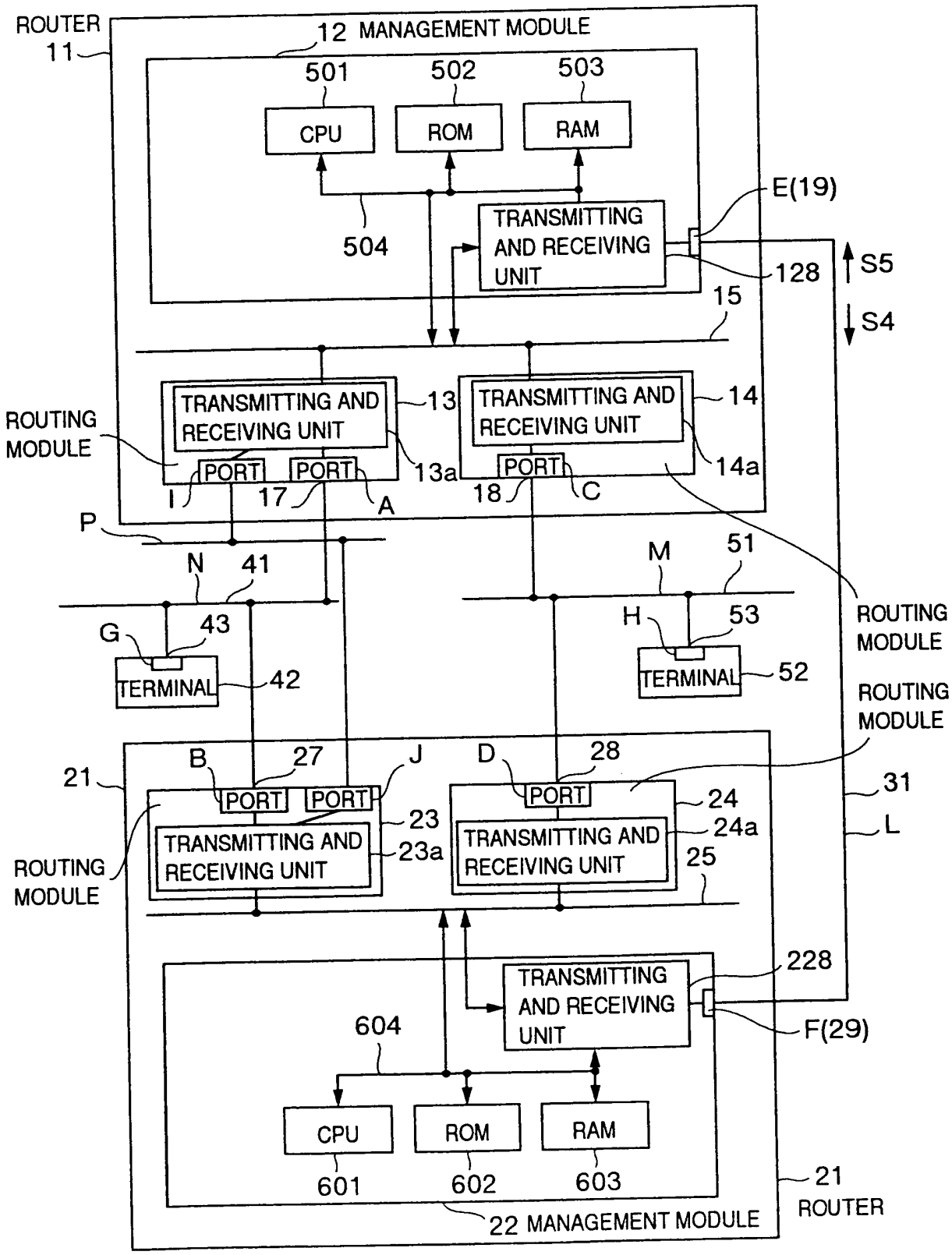

ROUTER
12
11
MANAGEMENT MODULE
1011
MIB CONTROL UNIT
19
E
31
L
15
1207
1206
MIB MEMORY UNIT
13
MIB MEMORY UNIT
1012
FAILURE
14
1013
1201
17
A(x→a)
18
C(y)
N
M
51
41
G
43
K
1043
1202
1209
1042
TERMINAL
MANAGE-MENT TERMINAL
H
53
1205
TERMINAL
52
1208
42
ROUTER
(b→x)B
27
(d)D
28
21
MIB MEMORY UNIT
23
MIB MEMORY UNIT
1022
24
1023
25
1204
1203
1021
F
MIB CONTROL UNIT
29
22

FIG.20


ROUTER
11
12 MANAGEMENT MODULE
501
502
503
CPU
ROM
RAM
504
TRANSMITTING AND RECEIVING UNIT
E(19)
128
S5
S4
15
TRANSMITTING AND RECEIVING UNIT
13
TRANSMITTING AND RECEIVING UNIT
14
ROUTING MODULE
PORT
PORT
13a
PORT
14a
I
17
A
18
C
P
N
41
M
51
ROUTING MODULE
G
43
H
53
TERMINAL
42
TERMINAL
52
ROUTING MODULE
21
B
27
J
D
28
31
PORT
PORT
PORT
24
23
TRANSMITTING AND RECEIVING UNIT
24a
L
ROUTING MODULE
23a
TRANSMITTING AND RECEIVING UNIT
25
228
TRANSMITTING AND RECEIVING UNIT
F(29)
604
CPU
ROM
RAM
601
602
603
21
ROUTER
22 MANAGEMENT MODULE